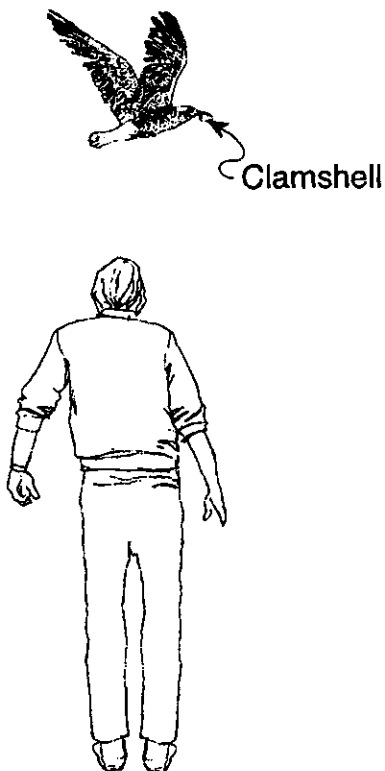
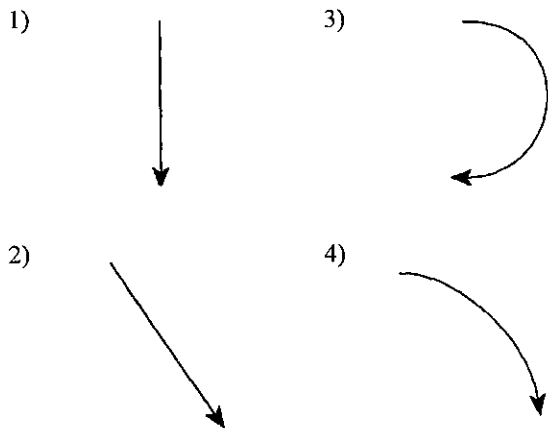


Projectiles & Inclined Planes

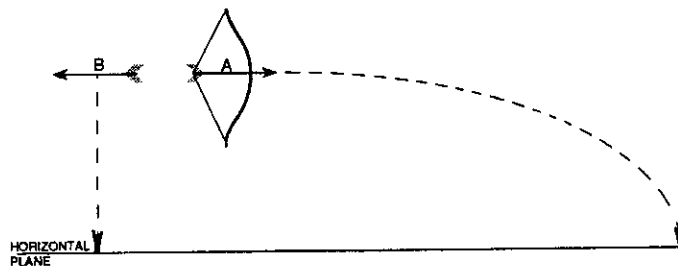
1. In the diagram below, a stationary observer on the ground watches as a seagull flying horizontally to the right drops a clamshell.



Which diagram best represents the path of the falling clamshell as seen by the observer?
[Neglect air resistance.]



2. A red ball and a green ball are simultaneously thrown horizontally from the same height. The red ball has an initial speed of 40. meters per second and the green ball has an initial speed of 20. meters per second. Compared to the time it takes the red ball to reach the ground, the time it takes the green ball to reach the ground will be
- 1) the same
 - 2) twice as much
 - 3) half as much
 - 4) four times as much
3. A book is pushed with an initial horizontal velocity of 5.0 meters per second off the top of a desk. What is the initial vertical velocity of the book?
- 1) 0 m/s
 - 2) 2.5 m/s
 - 3) 5.0 m/s
 - 4) 10. m/s
4. A golf ball is propelled with an initial velocity of 60. meter per second at 37° above the horizontal. The horizontal component of the golf ball's initial velocity is
- 1) 30. m/s
 - 2) 36 m/s
 - 3) 40. m/s
 - 4) 48 m/s
5. Above a flat horizontal plane, an arrow, *A*, is shot horizontally from a bow at a speed of 50 meters per second, as shown in the diagram below. A second arrow, *B*, is dropped from the same height and at the same instant as *A* is fired.

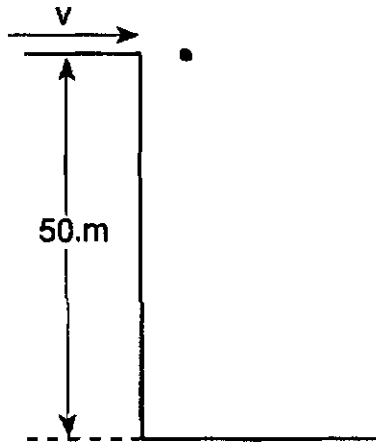


Neglecting air friction, compared to the amount of time *A* takes to strike the plane, the amount of time *B* takes to strike the plane is

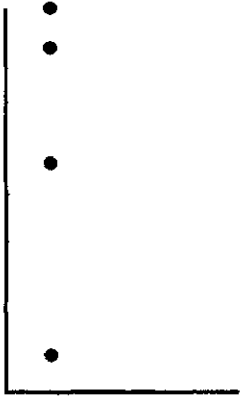
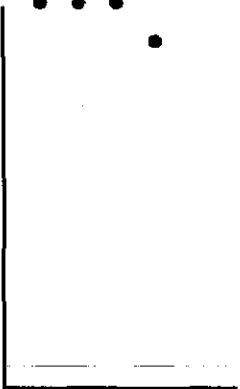
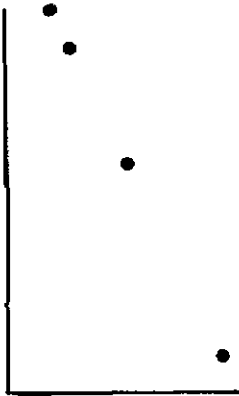
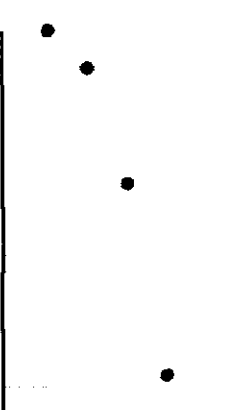
- 1) less
- 2) greater
- 3) the same

Projectiles & Inclined Planes





6. A ball is projected horizontally to the right from a height of 50. meters, as shown in the diagram below.



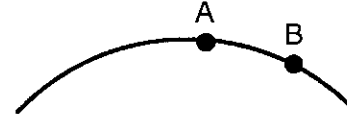
Which diagram best represents the position of the ball at 1.0-second intervals? [Neglect air resistance.]

- 1) 
- 2) 
- 3) 
- 4) 





7. A ball is fired vertically upward at 5.0 meters per second from a cart moving horizontally to the right at 2.0 meters per second. Which vector best represents the resultant velocity of the ball when fired?

- 1) 
- 2) 
- 3) 
- 4) 

8. The diagram below represents the path of an object after it was thrown.

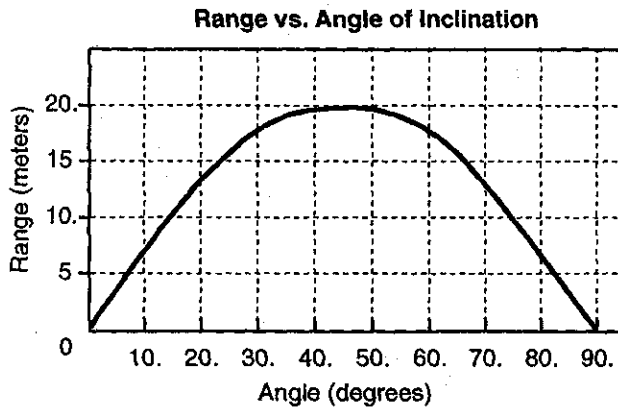


What happens to the object's acceleration as it travels from A to B? [Neglect friction.]

- 1) It decreases. 3) It remains the same.
- 2) It increases.
9. An object is thrown into the air and follows the path shown in the diagram above. Which vector best represents the acceleration of the object at point A? [Neglect air friction.]
- 1) 
- 2) 
- 3) 
- 4) 
10. A bullet is fired from a rifle with a muzzle velocity of 100. meters per second at an angle of $30.^\circ$ above the horizontal. What is the magnitude of the vertical component of the muzzle velocity?
- 1) 0.0 m/s 3) 87. m/s
- 2) 50. m/s 4) 100. m/s

Projectiles & Inclined Planes

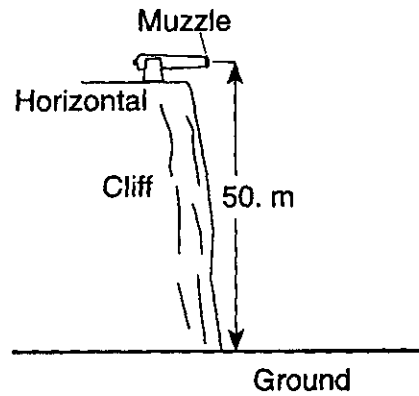
11. Projectiles are fired from different angles with the same initial speed of 14 meters per second. The graph below shows the range of the projectiles as a function of the original angle of inclination to the ground, neglecting air resistance.



The graph shows that the range of the projectiles is

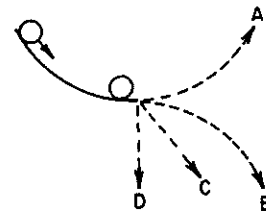
- 1) the same for all angles
- 2) the same for angles of 20° and 80°
- 3) greatest for an angle of 45°
- 4) greatest for an angle of 90°

12. The diagram below shows the muzzle of a cannon located 50. meters above the ground. When the cannon is fired, a ball leaves the muzzle with an initial horizontal speed of 250. meters per second. [Neglect air resistance.]



Which action would most likely increase the time of flight of a ball fired by the cannon?

- 1) pointing the muzzle of the cannon toward the ground
 - 2) moving the cannon closer to the edge of the cliff
 - 3) positioning the cannon higher above the ground
 - 4) giving the ball a greater initial horizontal velocity
13. A ball rolls down a curved ramp as shown in the diagram below. Which dotted line best represents the path of the ball after leaving the ramp?

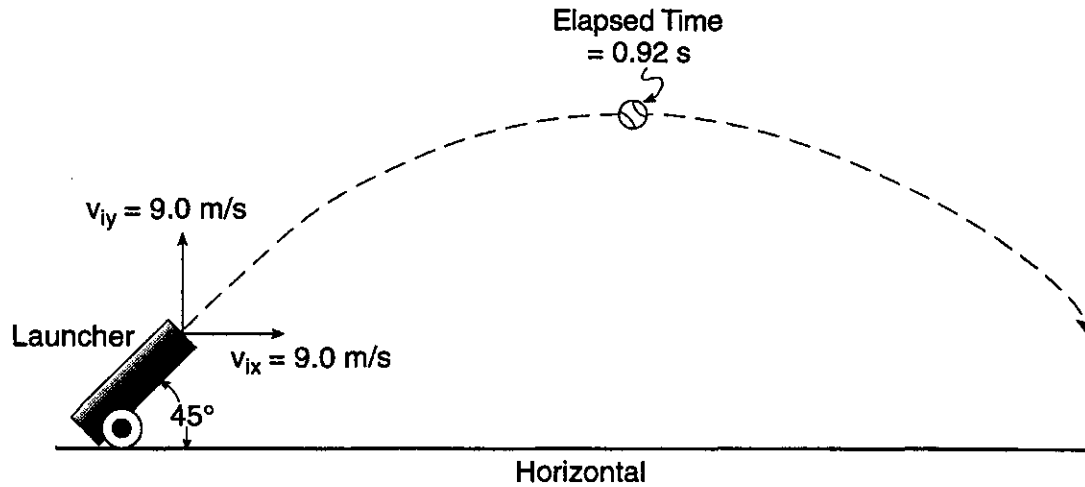


- | | |
|------|------|
| 1) A | 3) C |
| 2) B | 4) D |

Projectiles & Inclined Planes

Base your answers to questions 14 and 15 on the diagram and information below.

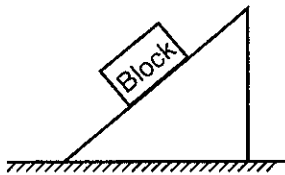
A machine launches a tennis ball at an angle of 45° with the horizontal, as shown. The ball has an initial vertical velocity of 9.0 meters per second and an initial horizontal velocity of 9.0 meters per second. The ball reaches its maximum height 0.92 second after its launch. [Neglect air resistance and assume the ball lands at the same height above the ground from which it was launched.]



14. The speed of the tennis ball as it leaves the launcher is approximately
- 1) 4.5 m/s
 - 2) 8.3 m/s
 - 3) 13 m/s
 - 4) 18 m/s
15. The total horizontal distance traveled by the tennis ball during the entire time it is in the air is approximately
- 1) 23 m
 - 2) 17 m
 - 3) 8.3 m
 - 4) 4.1 m

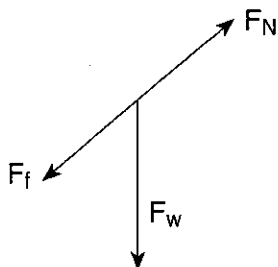
Projectiles & Inclined Planes

16. The diagram below represents a block at rest on an incline.

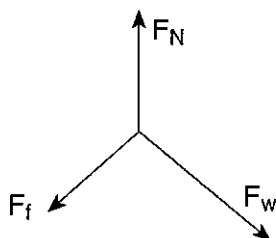


Which diagram best represents the forces acting on the block? (F_f = frictional force, F_N = normal force, and F_w = weight.)

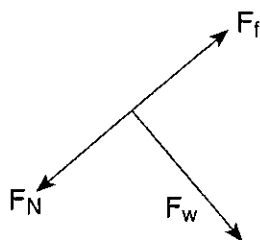
1)



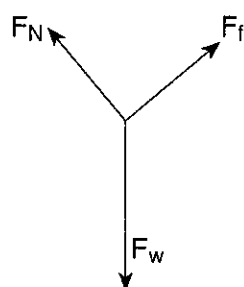
2)



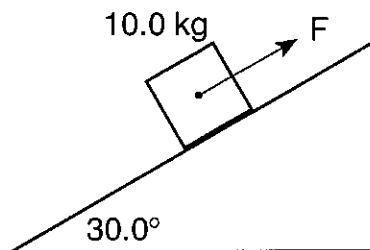
3)



4)



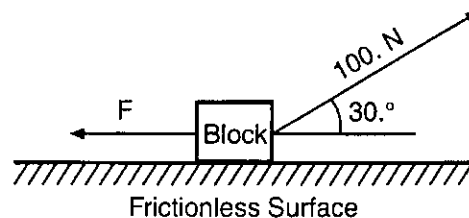
17. The diagram below shows a 10.0-kilogram mass held at rest on a frictionless 30.0° incline by force F .



What is the approximate magnitude of force F ?

- | | |
|-----------|-----------|
| 1) 9.81 N | 3) 85.0 N |
| 2) 49.1 N | 4) 98.1 N |

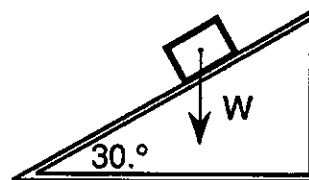
18. The diagram below shows a block on a horizontal frictionless surface. A 100.-newton force acts on the block at an angle of $30.^\circ$ above the horizontal.



What is the magnitude of force F if it establishes equilibrium?

- | | |
|-----------|-----------|
| 1) 50.0 N | 3) 100. N |
| 2) 86.6 N | 4) 187 N |

19. In the diagram below, the weight of a box on a plane inclined at $30.^\circ$ is represented by the vector W .

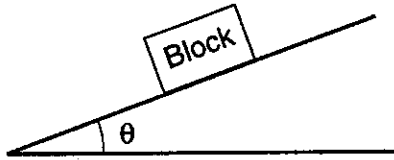


What is the magnitude of the component of the weight (W) that acts parallel to the incline?

- | | |
|-------------|-------------|
| 1) W | 3) $0.87 W$ |
| 2) $0.50 W$ | 4) $1.5 W$ |

Projectiles & Inclined Planes

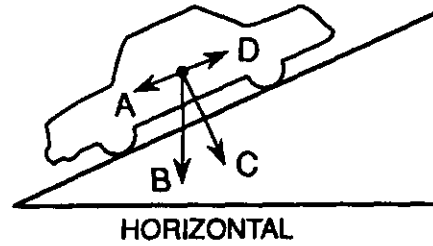
20. In the diagram below, a block rests on a ramp, making angle θ with the horizontal.



If angle θ is increased, what will occur?

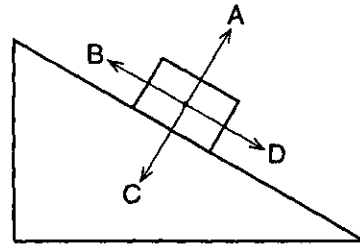
- 1) The block's mass will decrease.
- 2) The block's weight will increase.
- 3) The block's component of weight parallel to the ramp will decrease.
- 4) The block's component of weight parallel to the ramp will increase.

21. The diagram below represents a car resting on a hill.



Which vector best represents the weight of the car?

- 1) A
 - 2) B
 - 3) C
 - 4) D
22. The diagram below represents a block sliding down an incline.



Which vector best represents the frictional force acting on the block?

- 1) A
- 2) B
- 3) C
- 4) D